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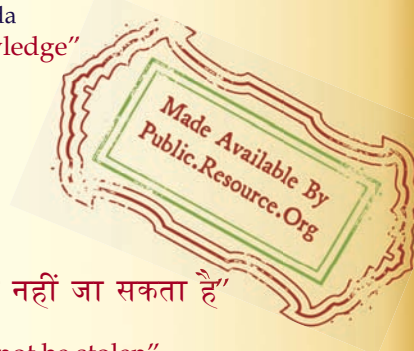
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Indian Standard
METHOD FOR
SENSORY EVALUATION OF BEER

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METHOD FOR SENSORY EVALUATION OF BEER

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Indian Standard

METHOD FOR SENSORY EVALUATION OF BEER

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 April 1975, after the draft finalized by the Sensory Evaluation Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 Beer has a complex flavour. The flavour constituents are derived from hops and malt and also develop as a result of fermentation and processing. The number of flavour components of beer is quite large and some of these are still not known. To evaluate the flavour by chemical and instrumental methods for routine quality control is therefore not practicable. The other limitation of instrumental analysis is that it cannot integrate the flavour impression as is gathered by human senses. The analysis of quality of beer can, therefore, be done more conveniently by sensory evaluation which gives the sum total of interactions of different flavour components. This standard, based on practices being followed by some beer manufacturers, has been evolved to guide the evaluation on a more acceptable and uniform manner.

0.3 In the preparation of this standard substantial assistance has been derived from the Central Food Technological Research Institute, Mysore; Alfred Jorgensen Laboratory, Copenhagen; and Experimental and Teaching Institute for Brewery, Berlin.

0.4 This standard is complimentary to IS : 3865-1966*.

0.5 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960†.

1. SCOPE

1.1 This standard prescribes basic requirements, method and evaluation card for sensory evaluation of beer.

*Specification for beer.

†Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 5126 (Part I)-1969* and IS : 5126 (Part II)-1969† and in addition the following definitions shall apply.

2.1.1 Acetaldehyde — Smell and taste reminiscent of apples.

2.1.2 Aromatic Malt Flavour — A desirable character (arising from a harmonious balance between ester, higher alcohol, sulphur, caramel and probably other components).

2.1.3 Autolysed — The characteristic stench and taste of autolysed yeast; rotton, putrid indicating faulty fermentation or storage.

2.1.4 Cabbage — Characterises the unpleasant bacterial flavour developed, for example, when unboiled wort is allowed to stand 24 hours at normal room temperature.

2.1.5 Diacetyl — The flavour sensation produced by related compounds, for example, other vicinal diketones; typically a buttery or harsh flavour.

2.1.6 Grainy, Husky, Straw — A typical off-flavour (due, for example, to faulty or excessive sparging).

2.1.7 Hoply — The desirable characteristic derived from hops used.

2.1.8 Hydrogen Peroxide — An undesirable characteristic reminiscent of rotten eggs from faulty fermentation or carbonation from impure gas.

2.1.9 Lacing — An appearance characteristics of lace like foam left on the surface of the glass above the liquid level. A desirable attribute.

2.1.10 Light-Struck — Repulsive off-flavour developed in beer on exposure to sunlight.

2.1.11 Metallic — Perceived by some as an astringent (inky) sensation. Metallic flavour refers especially to iron and other metals, being tasteless in concentrations usually found in beer.

2.1.12 Papery — Disagreeable smell and taste reminiscent of damp paper.

2.1.13 Phenolic — Distinctive off-flavour (can be due to infection with ellipsoideus wild yeast) or carry over of disinfectants like chlorine.

2.1.14 Smoky — Generally considered off-flavour except where it is intentionally made a desirable attribute derived from smoked malt.

*Glossary of general terms for sensory evaluation of foods: Part I Methodology.

†Glossary of general terms for sensory evaluation of foods: Part II Quality characteristics.

2.1.15 Sulphury, Sulphitic — Reminiscent of burnt match stick.

2.1.16 Tart — Same as sour.

2.1.17 Warty — The characteristic raw taste of beer fermented insufficiently; an inharmonious mixture of sweetness and bitterness.

3. GENERAL TEST CONDITIONS

3.1 Laboratory Set-Up — The laboratory set-up shall be as given in 4 of IS : 6273 (Part I)-1971*.

3.2 Lighting — Lighting should be as given in 4 of IS : 6273 (Part I)-1971*.

3.3 Time of Testing — The test should be carried out by the panelists at least one hour before their lunch [(see IS : 6273 (Part I)-1971]*. The morning hours during 0900 h to 1200 h should be preferred.

4. PANELISTS

4.1 Selection — The persons with normal sensitivity for basic taste and odour should be selected. They should be given a thorough training as prescribed in 4.2.2 and 4.2.3.

NOTE — A separate Indian Standard on panel selection is under preparation.

4.2 Training

4.2.1 Preparation of Beer Samples for Training — The sample should be prepared from a type of beer which does not have a strong aroma. The sample should be free from off-flavour before experimental samples are prepared from it. The additions mentioned below should be made with the aid of a pipette which is emptied near the bottom of bottle so that no part of the addition is lost when the bottle is fobbed before recrowing. The samples should be served a day after the preparations. The following types of samples may be used:

- Control** — 2 ml distilled water per 650 ml bottle of beer. It should be used for comparison with each of the remaining samples.
- Dilution** — Addition of 15 percent oxygen-free carbonated water. Ordinary mineral water is also suitable.
- Sugar** — 4 g/l sucrose; per 650 ml bottle of beer, add 3.4 ml of a solution containing 50 g/100 ml.
- Ester** — 2 mg/l amyl acetate; per 650 ml bottle of beer, add 2 ml of a solution containing 0.75 ml amyl acetate in 1 000 ml distilled water.

*Guide for sensory evaluation of foods: Part I Optimum requirements.

- e) *Diacetyl* — 0.3 mg/l; per 650 ml bottle of beer, add 2 ml of a solution containing 0.10 ml diacetyl in 1 000 ml distilled water.
- f) *Metal* — 2 mg/l ferrous sulphate; per 650 ml bottle of beer, add 2 ml of a solution containing 3.3 g ferrous sulphate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) in 1 000 ml distilled water.
- g) *Sunlight* — An unopened bottle of beer is exposed to direct sunlight. The time required for development of a suitable intensity depends on the intensity of the sunlight, the colour of the beer and the bottle, the sensitivity of the beer, etc, and may vary from a few minutes to several hours.
- h) *Oxidation* — Uncap a bottle of beer, replace the head-space gas with air by blowing out with a rubber ball, recrown the bottle and store it for 24 hours at 50°C.
- j) *Mustiness* — Soak a slice of white bread with tap water in a petri dish, inoculate with *Penicillium glaucum*, for 3 to 4 days at 25°C, add about 50 ml beer, swirl, filter and add a suitable quantity, about 20 ml per 650 ml bottle of beer.
- k) *Smoky (Ellipsoid Wild Yeast)* — Addition of 10 percent of a wild yeast beer prepared by fermenting in the laboratory, wort inoculated with *Saccharomyces cerevisiae* var *ellipsoideus*.
- m) *Ethyl Acetate* — 50 ppm; per 650 ml bottle of beer, add 2 ml of a solution containing 1.75 ml ethyl acetate in 100 ml water.
- n) *Amyl Acetate (Banana)* — 3 ppm; per 650 ml bottle of beer, add 2 ml of a solution of 1.05 ml isoamyl acetate in 1 000 ml water.
- p) *Ethyl Caproate (Apple)* — 0.3 ppm; per 650 ml bottle of beer, add 2 ml of a solution of 0.21 ml ethyl caproate in 2 000 ml water.
- q) *Higher Alcohols (Fusel Oil)* — 150 ppm; per 650 ml bottle of beer, add 2 ml of a solution of 5.25 ml 2-methyl butanol in 100 ml water.
- r) *Acetaldehyde* — 35 ppm; per 650 ml bottle of beer, add 2 ml of a solution of 1.23 ml acetaldehyde in 100 ml water.
- s) *Fatty Acids* — 15 ppm; per 650 ml bottle of beer, add 2 ml of a solution of 0.53 ml caprylic acid in 100 ml water.
- t) *Sulphury* — In a 250-ml beaker, add some pieces of zinc metal and approximately 10 ml of 1 to 2 N sulphuric acid. When a violent evolution of hydrogen is observed, add 100 ml beer and test the odour after 1 to 2 minutes.

- u) *Dimethyl Sulphide (Cooked Onion)* — 50 ppm; per 650 ml bottle of beer, add 2 ml of a solution prepared by diluting 1 : 100 of a solution containing 0.18 ml dimethyl sulphide per 100 ml water. Cool dimethyl sulphide to 20°C.
- v) *Ethyl Mercaptan* — 2.5 ppm; 650 ml bottle of beer, add 2 ml of a solution prepared by adding in the proportion of 1 : 2 000 of a solution containing 0.18 ml ethyl mercaptan per 100 ml water.

4.2.2 Training of Beginners — New panelists should be given some experience in evaluating ordinary samples as well as identified prepared samples. A series of 20 judgements shall be obtained from each prospective panelist utilizing a pair of samples with known differences. To compensate for the known variations from day to day, the qualifying test is given for a 3-day period. Those who make an acceptable (75 percent correct) score should be chosen for further training (see 4.2.3). Patience is necessary as it may take up to 6 months' daily evaluation tests, before a beginner can pass the tests.

4.2.3 Training of Panel Members — Each panelist should be tested at least every 3 months for his ability to evaluate each of the beer faults (see 4.2.1). The panelist should be given 4 sets of triangles; he should be told that each set contains control and a specified additive, and that he should attempt to indicate which glass contains the additive. For each panelist it should be noted whether he has had 0, 1, 2, 3 or 4 correct triangles with the fault in question; triangles in which the odd sample is correctly indicated but incorrectly identified are taken as incorrect. A single day's evaluation is not sufficient for the assessment of a panelist's ability to evaluate a particular fault; for this reason his earlier results with the same fault should be taken into account. On the other hand it is desirable to know whether a panelist is losing his ability to evaluate the fault. Both these situations may be covered in the manner described in 4.2.3.1 to 4.2.3.4.

NOTE — For routine evaluation the chemicals mentioned at (d), (g), (k), (p), (q), (r), (s), (t) and (v) given under 4.2.1 may not be used.

4.2.3.1 Each type of beer fault should be tested at least every three months, and each panelist should evaluate 4 triangles on each occasion.

4.2.3.2 The evaluation should be based on the last three triangles and only on these; this means that the evaluation should cover evaluations made within one year.

4.2.3.3 The panelists' proficiency should be characterized as *, **, or *** according to the following table:

<i>Number of Correct Triangles Among the Latest 12 Trinagles</i>	<i>Statistical Significance</i>	<i>Probability that the Result is Based on Chance only</i>
6	*	5 percent
7	**	1 percent
8	***	0.1 percent

Each member of the panel should attain and retain at least one asterisk for each type of beer fault. The leader of the panel should see that not only should there be a sufficient number of panelists present at each evaluation, but these should also represent a sufficient number of asterisks for the types of beer faults which are to be judged.

4.2.3.4 The list of the qualifications of the members of the panel may be kept in the form shown in the following example:

<i>Date</i>	<i>Diacetyl 0.3 mg/l in Lager Beer</i>														
	<i>Panelists</i>														
	<i>A</i>			<i>B</i>			<i>C</i>			<i>D</i>			<i>E</i>		
	<i>c</i>	<i>t</i>	<i>q</i>	<i>c</i>	<i>t</i>	<i>q</i>	<i>c</i>	<i>t</i>	<i>q</i>	<i>c</i>	<i>t</i>	<i>q</i>	<i>c</i>	<i>t</i>	<i>q</i>
2 Jan 1964	0	—	—	4	—	—	3	—	—	4	—	—	3	—	—
10 Apr 1964	2	—	—	1	—	—	2	—	—	3	—	—	1	—	—
3 Jul 1964	3	5	—	2	7	**	3	8	***	2	9	***	2	6	*
8 Oct 1964	2	7	**	3	6	*	2	7	**	2	7	**	2	5	—
5 Jan 1965	2	7	**	2	7	**	2	7	**	3	7	**	2	6	*
14 Apr 1965	2	6	*	3	8	***	2	6	*	3	8	***	1	5	—

c is the number of triangles identified correctly on a particular day;

t is the total of the latest 3 *c*'s; and

q is the panelist's present qualification with regard to the fault in question.

4.2.4 Number of Panelists — The criteria for deciding the number of panelists should be as laid down in IS : 6273 (Part II)-1971†.

5. SAMPLING, PREPARATION AND PRESENTATION

5.1 Sampling — Samples should be drawn according to the provisions given in IS : 3753-1967‡.

†Guide for sensory evaluation of foods: Part II Methods and evaluation cards.

‡Methods of sampling of alcoholic drinks.

5.2 Preparation of Test Sample — The samples should be kept in a refrigerator and temperature of the sample at the time of testing should be below the test temperature. As beer is a carbonated product, it should not be opened before hand. The bottle should be opened after the panelists are ready for testing.

5.3 Temperature at Evaluation — The temperature of the sample should be as close as possible to the temperature at which beer is normally taken. It is recommended that the temperature of the sample should be $5 \pm 1^\circ\text{C}$. For attribute analysis, suitable temperature should be selected.

5.4 Amount of Each Sample — The panelists should be allowed to have a sufficient amount of sample necessary to make judgements. About 100 ml of sample should be sufficient.

5.5 Number of Samples — Though the number of samples to be tested at one session depends on amount of differences between the samples, ability of the panelist and degree of refinement desired in results, it should not be more than 5 samples per sitting.

5.6 Coding — It should be done according to 7.7 of IS : 6273 (Part I)-1971*.

5.7 Serving of Test Sample — The sample should be served to different booths through a hatch. The bottles should be opened immediately before serving. The beer should be poured from about 8 cm above the rim of the glass in an inclined way, so that the head retention is maintained and could be judged. One sample should be given at a time.

6. APPARATUS

6.1 Tasting Glass — The glass as described in 'Specification for tasting glass for liquid samples' (under preparation) should be employed.

NOTE — Till such time, the standard under preparation is published the glass shall be used as agreed to between the purchaser and the supplier.

7. PROCEDURE

7.1 Test Method — The panelists should always make their observations systematically and follow the sequence given in the evaluation cards.

7.1.1 Evaluation Card A — This evaluation card should be used for day-to-day quality control with trained panelists (see Note under 4.2.3). This is particularly suitable for overall quality evaluation where different batches or brands of beer are evaluated. The card is given in Table 1.

7.1.2 Evaluation Card B — This evaluation card should be used in detailed work to detect finer differences and defects in quality of beer samples by the test known as profile analysis. The card is given in Table 2.

*Guide for sensory evaluation of foods: Part I Optimum requirements.

TABLE 1 EVALUATION CARD A

(Clause 7.1.1)

Name of Panelist _____

Date _____

Origin of Beer _____

Type of Beer _____

Evaluate the attributes using the scale

Judge the attributes at Serial No. (i), (ii), (iii) and (ix) for each sample and others in case asked for
For characterization to explain the given scores, use the expressions given below for each attribute
Use the same evaluation card for paired comparison and duo-trio or triangle tests where preference or odd sample is marked when required along with total quality in the column characterization

Scale for attributes — Intensity/Quality

1. Uncertain/impure
2. Slight but noticeable/minor defectives or slightly atypical
3. Distinctive strong/typical
4. Intense/untypical, pure

SL No. QUALITY ATTRIBUTES

CODE No.

CODE No.

Points Characterization

Points Characterization

- i) Odour
- ii) Flavour (including body)
- iii) Bitterness
- iv) Freshness (based on CO₂)
- v) Aroma of hops
- vi) Quality of bitterness
- vii) Mouth feel
- viii) Other impressions
- ix) Total quality

NOTE — Suggested terms for different attributes should be as follows:

- i) *Odour*: Aromatic, malt, worty, hoppy/oxidized, diacetyl, musty, phenolic, sulphury
- ii) *Flavour*: As in (i); also sour, caramelized, metallic, cardboardy, sulphury
- iii) *Bitterness*: Optimally bitter, typical hops/insufficient, excessive, astringent
- iv) *Freshness*: Fresh/stale
- v) *Aroma of hops*: Full intensity, fragrant/weak, grassy
- vi) *Quality of bitterness*: Smooth, pleasant, disappearing/harsh, unpleasant, foreign, persistent
- vii) *Mouth feel*: Full body (optimal)/thin, satiating
- viii) *Total quality*: A — just acceptable, B — acceptable, C — good, D — very good (excellent)

Signature _____

TABLE 2 EVALUATION CARD B

(Clause 7.1.2)

Name of Panelist _____

Date _____

Origin of Beer _____

Type of Beer _____

Scale for Sensory Impressions

(blank) = no comment, absent
 ? = suspicion, uncertain
 1 = slight
 2 = distinct
 3 = much

Scale for General Evaluation

1 = undrinkable 6 = fairly good
 2 = bad 7 = good
 3 = poor 8 = very good
 4 = rather poor 9 = excellent
 5 = medium, just acceptable 10 = superb

			A	B	C	D
Main Characteristics Characteristics considered positive, neutral or negative, are marked +, 0 or -, respectively	Appearance on Pouring	foam, lacing	+			
		lacking CO ₂	-			
		haze, floaters	-			
	Malt / Yeast Flavour	aromatic	+			
		fresh	+			
		bland	0			
		characterless	-			
		caramel	0			
		burnt	-			
		too estery	-			
		too much fusel oil	-			
		sweet	0			
		cloying, too sweet	-			
		Body	full	+		
	thin, watery		-			
	satiating		-			
	Hop Aroma and Bitterness	fragrant aroma	+			
		stale, cheesy	-			
		pleasant, bitter	+			
		insufficient bitter	-			
excessive bitter		-				
Serious Off-Flavours If any of these faults is present at level 1, 2 or 3, the sample cannot get more than 5, 4 or 3 points, respectively	harsh bitter	-				
	cabbage	-				
	smoky	-				
	phenolic	-				
	musty	-				
	diacetyl	-				
	autolysed	-				
Other-Off-Flavours If any of these faults is present at level 2 or 3, the sample cannot get more than 6 points	light-struck	-				
	acetaldehyde	-				
	hydrogen sulphide	-				
	grainy, huskey, straw	-				
	grassy	-				
	worty	-				
	sour	-				
	sulphitic, SO ₂	-				
	oxidized	-				
	astringent	-				
	Earthy	-				
	mousy	-				
	papery	-				
	rubbery	-				
	metallic	-				
other	-					
Overall Evaluation						
			Signature _____			

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8. ANALYSIS OF DATA

8.1 The data should be analysed by binomial tables in training session and paired comparison.

8.2 Data from evaluation card A in respect of individual attribute and overall quality, and data from evaluation card B for overall quality should be analysed by analysis of variance.

INDIAN STANDARDS

ON

SENSORY EVALUATION

IS :

- 5126 (Part I)-1969 Glossary of general terms for sensory evaluation of foods: Part I
Methodology
- 5126 (Part II)-1969 Glossary of general terms for sensory evaluation of foods: Part II
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- 6273 (Part I)-1971 Guide for sensory evaluation of foods: Part I Optimum requirements
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